

REMARKS

Claims 1-7, 9, 13-15, 23-29, 33-35, 39-41 and 82-83 are pending in this application. Claims 1 and 22 have been amended. Claim 9 has been rewritten in independent form, as suggested in the last Office Action, and is now in condition of allowance. Claim 88 has been canceled.

Claims 1 and 22 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Takeuchi et al. (U.S. Patent No. 5,017,513) ("Takeuchi"). The rejection is respectfully traversed.

The claimed invention is a non-aqueous etching mixture which consists essentially of an alcohol in combination with at least two inorganic acids. As such, amended independent claim 1 recites an etching composition consisting essentially of "a non-aqueous composition of an alcohol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group consisting of sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid." Independent amended claim 22 also recites an etching composition consisting essentially of "a non-aqueous composition of an alcohol and at least two different inorganic acids selected from the group consisting of phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid."

Takeuchi does not disclose the limitations of claims 1 and 22. Takeuchi discloses a "solution of phosphoric acid, hydrofluoric acid and alcohol in volume ratio of 100:1:100" (col. 4, lines 25-28) for removing "foreign projections 5 deposited on the side wall of the polysilicon pattern 3". (Col. 3, lines 32-38; Figures 1A, 1B). Takeuchi does not disclose, however, "a non-aqueous composition of an alcohol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group consisting of sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid," as amended independent claim 1 recites. Takeuchi discloses only phosphoric and hydrofluoric acids, but these acids are not recited as limitations of amended independent claim 1.

Further, Takeuchi does not disclose “a non-aqueous composition of an alcohol and at least two different inorganic acids selected from the group consisting of phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid,” as independent amended claim 22 recites. Applicants note that, according to claim 22, the “two *different* inorganic acids” must be selected from the above-recited group, which does not include hydrofluoric acid. Thus, the limitations of independent amended claim 22 are not described in Takeuchi and the subject matter of claims 1 and 22 is not anticipated under 35 U.S.C. § 102.

Claims 2-7, 9, 13-15 and 33-35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Takeuchi et al. (U.S. Patent No. 5,017,513) (“Takeuchi”) as applied to claims 1 and 22. The rejection is respectfully traversed.

As noted above, the claimed invention teaches an etching mixture which consists essentially of a non-aqueous composition of an alcohol in combination with two inorganic acids. As such, dependent claim 2 recites that the alcohol is “a polyhydric alcohol,” while dependent claim 3 recites “ethylene glycol, propylene glycol, butylene glycol, dipropylene glycol, sorbitol, hexylene glycol, 1,3-dibutylene glycol, 1,2,6-hexanetriol and 1,5-pentanediol” as choices for the polyhydric alcohol. Dependent claim 5 further recites that the alcohol is propylene glycol, while dependent claims 13 and 33 recite that the ratio of alcohol to a first acid to a second acid is of about 10-50:5-40:1, while dependent claims 15 and 35 further limit such ratio to about 30:20:1.

The subject matter of claims 2-7, 9, 13-15 and 33-35 would not have been obvious over Takeuchi. First, Takeuchi is silent about an etching solution consisting essentially of “a non-aqueous composition of an alcohol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group consisting of sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid,” as independent amended claim 1 recites, or about “a non-aqueous composition of an alcohol and at least two different inorganic acids selected from the group consisting of phosphoric acid, sulfuric

acid, boric acid, carbonic acid, perchloric acid and sulfurous acid,” as independent amended claim 22 recites.

Second, Takeuchi is also silent about ratios of alcohol to a first acid to a second acid recited in dependent claims 13 and 33. Takeuchi notes only that the solution of phosphoric acid, hydrofluoric acid and alcohol has a “volume ratio of 100:1:100” (col. 4, lines 25-28), and not a volume ratio of 5-40:1:10-50 or 20:1:30, as dependent claims 13 and 33 recite. Accordingly, the subject matter of claims 2-7, 9, 13-15 and 33-35 would not have been obvious over Takeuchi and the rejection of these claims is respectfully requested.

Claims 39-41 and 83 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Holoubek J. (CS 8801729A) (“Holoubek”). The rejection is respectfully traversed.

As noted above, the claimed invention recites a non-aqueous etching composition which consists essentially of an alcohol in combination with at least two inorganic acids. As such, independent claim 39 recites “a non-aqueous composition comprising propylene glycol, nitric acid and hydrofluoric acid” in a ratio of 10-50:5-40:1 for selectively etching doped polysilicon to undoped polysilicon. The ratio of propylene glycol to nitric acid to hydrofluoric acid is further defined in claims 40 and 41 as of about 20-40:10-30:1 and 30:20:1, respectively. Independent claim 83 further recites an etching composition consisting essentially of “a non-aqueous composition of propylene glycol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group consisting of hydrofluoric acid, phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid.”

The subject matter of claims 39-41 and 83 would not have been obvious over Holoubek. First, Holoubek discloses a mixture of nitric acid and hydrofluoric acid, diluted by ethylene glycol as a “[B]ath for etching chromium silicide layer.” (Title; Abstract). Holoubek is silent, however, as to the presence of propylene glycol in non-aqueous etching

compositions. Holoubek is further silent about “a non-aqueous composition comprising propylene glycol, nitric acid and hydrofluoric acid” (claim 39), or about “a non-aqueous composition of propylene glycol and at least two inorganic acids” (claim 83). Second, Holoubek is silent about any ratio of hydrogen fluoride to nitric acid, or any ratio of propylene glycol to nitric acid to hydrofluoric acid. Third, Holoubek is silent about using propylene glycol, or using propylene glycol at 35°C, on doped and undoped polysilicon. The crux of Holoubek is a bath etch for etching a particular layer of an integrated circuit, that is a chromium silicide layer, and not for etching doped to undoped polysilicon. Fourth, Holoubek teaches a weak, *diluted* solution of ethylene glycol and nitric and hydrofluoric acids as a bath etch for chromium silicides. In contrast, the non-aqueous composition comprising propylene glycol of the claimed invention are not weak, but rather have a high concentration of a first acid relative to propylene glycol, that is a ratio of 5-40:10-50 (claim 39) or 10-30:20-40 (claim 40) or 20:30 (claim 41). Accordingly, the subject matter of claims 39-41 and 83 would not have been obvious over Holoubek, and withdrawal of the rejection of above-mentioned claims is respectfully requested.

A marked-up version of the changes made to the specification and claims by the current amendment is attached. The attached page is captioned “Version with markings to show changes made.”

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

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Version With Markings to Show Changes Made

1. (five times amended) An etching composition consisting essentially of:

a non-aqueous composition of an alcohol and at least two inorganic acids, wherein one of said inorganic acids is selected from the group consisting of [phosphoric acid,] sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid.

9. (twice amended) [The composition according to claim 1] An etching composition consisting essentially of:

a non-aqueous composition of an alcohol and at least two inorganic acids, wherein said inorganic acids are selected from the group consisting of nitric acid, phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid.

22. (twice amended) An etching composition consisting essentially of:

a non-aqueous composition of an alcohol and at least two different inorganic acids selected from the group consisting of [hydrofluoric acid,] phosphoric acid, sulfuric acid, boric acid, carbonic acid, perchloric acid and sulfurous acid.